Chapter 7
Using Data Flow Diagrams

Systems Analysis and Design

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Sixth Edition

Major Topics

- Data flow diagram symbols
- Data flow diagram levels
- Creating data flow diagrams
- Physical and logical data flow diagrams
- Partitioning
- Event driven modeling
- Use case and data flow diagrams

Data Flow Diagrams

- DFDs are one of the main methods available for analyzing data-oriented systems.
- DFDs emphasize the logic underlying the system.
- The systems analysts can put together a graphical representation of data movement through the organization.

Advantages of the Data Flow Diagram Approach

Four advantages over narrative explanations of data movement:

- Freedom from committing to the technical implementation too early.
- Understanding of the interrelationships of systems and subsystems.
- Communicating current system knowledge to users.
- Analysis of the proposed system.

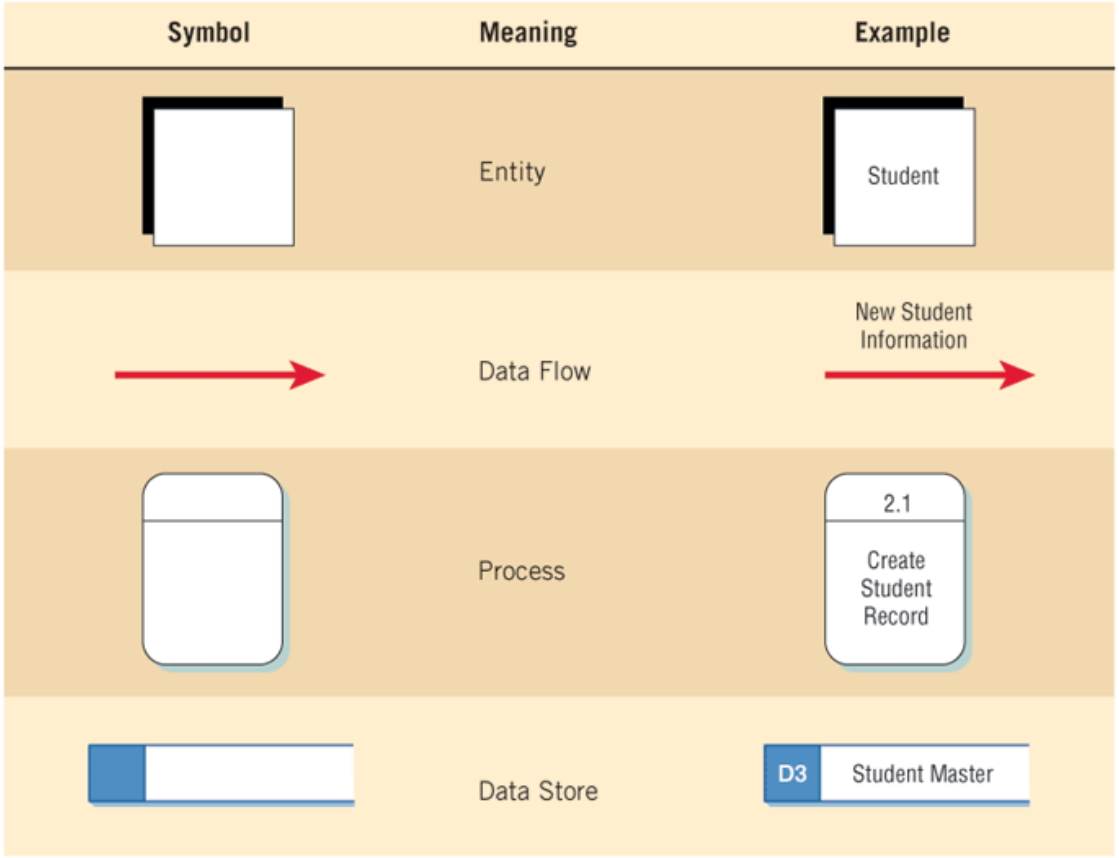
Basic Symbols

Four basic symbols are:

- A double square for an external entity--a source or destination of data.
- An arrow for movement of data from one point to another.
- A rectangle with rounded corners for the occurrence of transforming process.
- An open-ended rectangle for a data store.

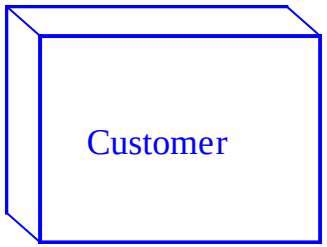
Basic Symbols

Figure 7.1
The four basic symbols used in data flow diagrams, their meanings, and examples.



External Entities

- Represent people or organizations outside of the system being studied
- Shows the initial source and final recipient of data and information
- Should be named with a noun, describing that entity

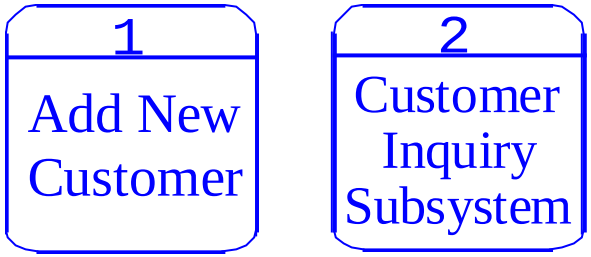


External Entities (Continued)

- External entities may be:
  - A person, such as CUSTOMER or STUDENT.
  - A company or organization, such as BANK or SUPPLIER.
  - Another department within the company, such as ORDER FULFILLMENT.
  - Another system or subsystem, such as the INVENTORY CONTROL SYSTEM.

Processes

- Represent either:
  - A whole system
  - A subsystem
  - Work being done, an activity



- Names should be in the form verb-adjective-noun
  - The exception is a process that represents an entire system or subsystem.

Data Stores

- Name with a noun, describing the data
- Data stores are usually given a unique reference number, such as D1, D2, D3.
- Include any data stored, such as:
  - A computer file or database.
  - A transaction file .
  - A set of tables .
  - A manual file of records.

Data Flow

- Data flow shows the data about a person, place, or thing that moves through the system.
- Names should be a noun that describes the data moving through the system.
- Arrowhead indicates the flow direction.
- Use double headed-arrows only when a process is reading data and updating the data on the same table or file.

Developing Data Flow Diagrams

Use the following guidelines:

- Create the context level diagram, including all external entities and the major data flow to or from them.
- Create Diagram 0 by analyzing the major activities within the context process.
  - Include the external entities and major data stores.
- Create a child diagram for each complex process on Diagram 0.

Creating Data Flow Diagrams

Detailed data flow diagrams may be developed by:

- Making a list of business activities.
- Analyzing what happens to an input data flow from an external entity.
- Analyzing what is necessary to create an output data flow to an external entity.

Creating Data Flow Diagrams

Detailed data flow diagrams may be developed by (continue):

- Examining the data flow to or from a data store.
- Analyzing a well-defined process for data requirements and the nature of the information produced.
- Noting and investigating unclear areas.

Data Flow Diagram Levels

- Data flow diagrams are built in layers.
- The top level is the Context level.
- Each process may explode to a lower level.
- The lower level diagram number is the same as the parent process number.
- Processes that do not create a child diagram are called primitive.

Context-Level Data Flow Diagram

- It contains only one process, representing the entire system.
- The process is given the number zero.
- All external entities are shown on the context diagram as well as major data flow to and from them.
- The diagram does not contain any data stores.

DFD Levels

- Insert Figure 4.3 here

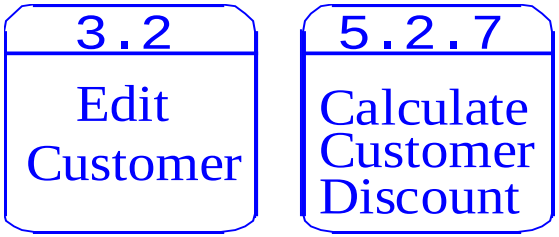
NOTE: confirm correct figure with author.

Diagram 0

- Diagram 0 is the explosion of the context level diagram.
- It should include up to 7 or 9 processes.
  - Any more will result in a cluttered diagram.
- Processes are numbered with an integer.
- The major data stores and all external entities are included on Diagram 0.

Child Diagrams

- Each process on diagram zero may be exploded to create a child diagram.
- Each process on a lower-level diagram may be exploded to create another child diagram.
- These diagrams found below Diagram 0 are given the same number as the parent process.
  - Process 3 would explode to Diagram 3.



Child Diagrams (Continued)

- Each process is numbered with the parent diagram number, a period, and a unique child diagram number.
- Examples are:
  - 3.2 on Diagram 3, the child of process 3.
  - 5.2.7 on Diagram 5.2, child of process 5.2.
  - On Diagram 3, the processes would be numbered 3.1, 3.2, 3.3 and so on.

Child Diagrams (Continued)

- External entities are usually not shown on the child diagrams below Diagram 0.
- If the parent process has data flow connecting to a data store, the child diagram may include the data store as well.

Child Diagrams (Continued)

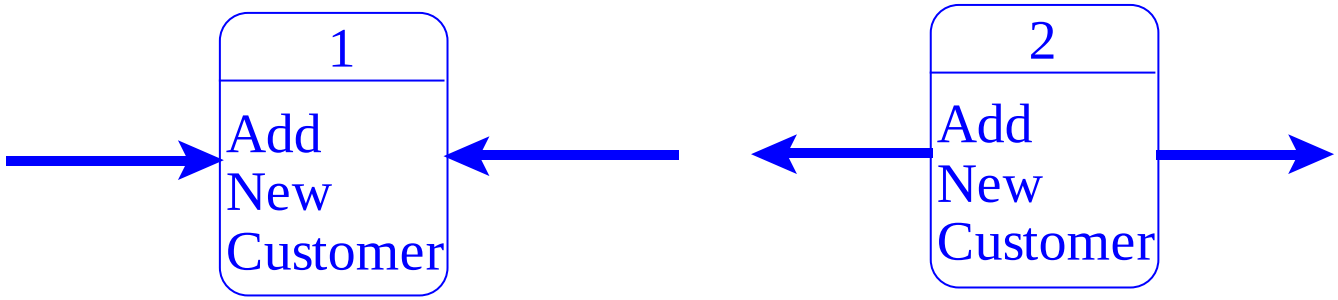
- A lower-level diagram may contain data stores not shown on the parent process, such as:
  - A file containing a table of information (such as a tax table).
  - A file linking two processes on the child diagram.
- Minor data flow, such as an error line, may be included on a child diagram.

Child Diagrams (Continued)

- An interface data flow is data that are input or output from a child diagram that matches the parent diagram data flow.
- Processes that do not create a child diagram are called primitive processes.
- Logic is written for these processes.

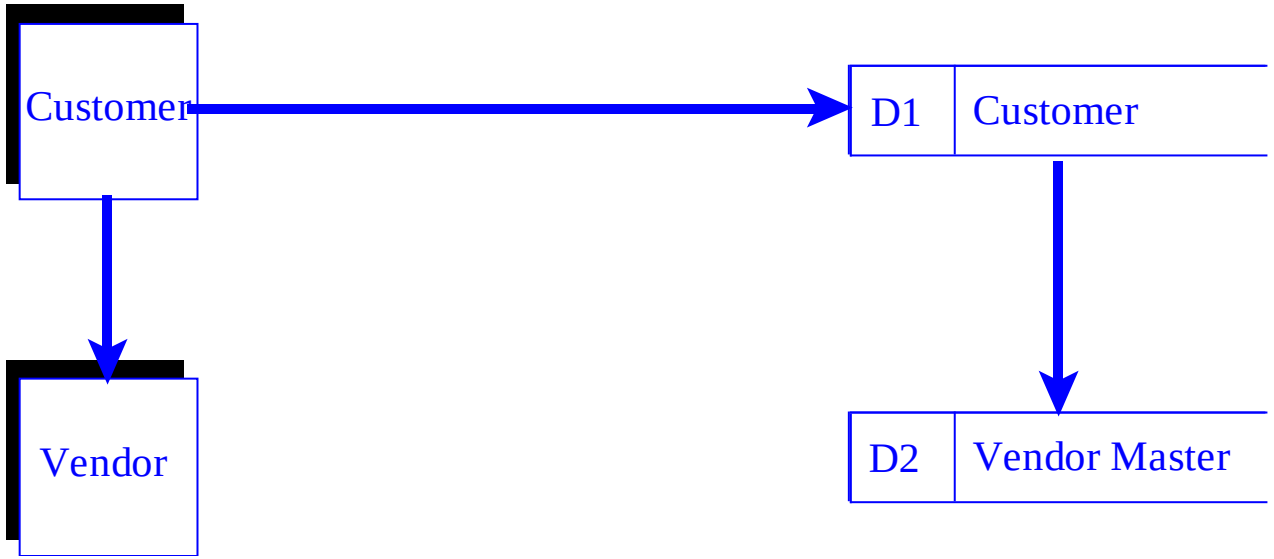
Data Flow Diagram Errors

- The following conditions are errors that occur when drawing a data flow diagram:
- A process with only input data flow or only output data flow from it.



Data Flow Diagram Errors (Continued)

- Data stores or external entities are connected directly to each other, in any combination.



Data Flow Diagram Errors (Continued)

- Incorrectly labeling data flow or objects
  - Examples are:
    - Labels omitted from data flow or objects.
    - Data flow labeled with a verb.
    - Processes labeled with a noun.
- Too many processes on a data flow diagram.
  - Nine is the suggested maximum.

Data Flow Diagram Errors (Continued)

- Omitting data flow from the diagram
- Unbalanced decomposition between a parent process and a child diagram
  - The data flow in and out of a parent process must be present on the child diagram.

Logical Data Flow Diagrams

- Logical data flow diagrams show how the business operates.
- They have processes that would exist regardless of the type of system implemented.

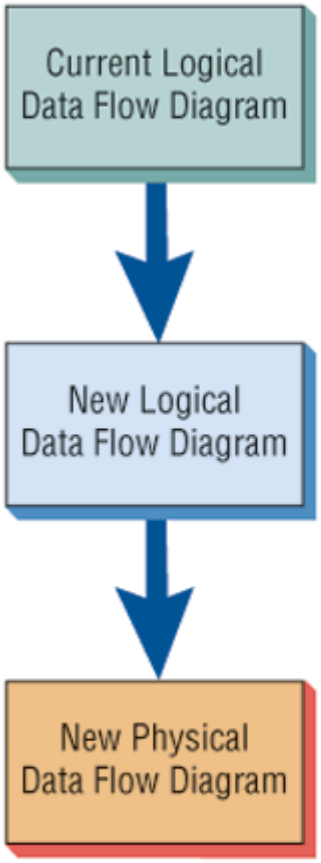
Data Flow Diagram Progression

The progression of creating data flow diagrams is:

- Create a logical DFD of the current system.
- Next add all the data and processes not in the current system that must be present in the new system.
- Finally derive the physical data flow diagram for the new system.

Data Flow Diagram Progression

Figure 7.8 The progression of models from logical to physical.



Derive the logical data flow diagram for the current system by examining the physical data flow diagram and isolating unique business activities.

Create the logical data flow diagram for the new system by adding the input, output, and processes required in the new system to the logical data flow diagram for the current system.

Derive the physical data flow diagram by examining processes on the new logical diagram. Determine where the user interfaces should exist, the nature of the processes, and necessary data stores.

Logical Data Flow Diagrams Advantages

Advantages of logical DFDs are:

- Better communication with users.
- More stable systems, since the design is based on a business framework.
- Increased understanding of the business by analysts.
- The system will have increased flexibility and be easier to maintain.
- Elimination of redundancy.

Physical Data Flow Diagrams

Physical data flow diagrams show how the system operates or how the new system will be implemented.

- Physical data flow diagrams include:
  - Clarifying which processes are manual and which are automated.
  - Describing processes in greater detail.
  - Sequencing processes in the order they must be executed.

Physical Data Flow Diagrams

Physical data flow diagrams include (continued):

- Temporary data stores and transaction files.
- Specifying actual document and file names.
- Controls to ensure accuracy and completeness.

CRUD

- Physical data flow diagrams include processes for adding, reading, changing, and deleting records.
- CRUD is an acronym for Create, Read, Update, Delete.
- A CRUD matrix shows which programs or processes add, read, update, or delete master file records.

Transaction Files

- Master or transaction database tables or files are used to link all processes that operate at different times.
- They are required to store the data from the process that creates the data to the process that uses the data.

Triggers and Events

- An input flow from an external entity is sometimes called a trigger, since it starts activities.
- Events cause the system to do something.
- An approach used to create a data flow fragment is to analyze events, which are summarized in an event table.

Event Tables

- An event table is used to create a data flow diagram by analyzing each event and the data used and produced by the event.
- Every row in an event table represents a unique activity and is used to create one process on the data flow diagram.

Use Case and Data Flow Diagrams

- A use case is another approach used to develop a data flow diagram.
- A use case is used to create a data flow diagram by providing a framework for obtaining processes, input, output, and data stores required for user activities.
- A use case shows the steps performed to accomplish a task.

Use Case

The major sections of a use case are:

- Use case name.
- Description.
- Trigger.
- Trigger type.
- Input name and source.
- Output name and destination.
- Steps performed.
- Information required for each step.

Partitioning

- Partitioning is the process of analyzing a data flow diagram and deriving a series of manual procedures and computer programs.
- A dashed line is drawn around a group of processes that are included in each computer program or manual procedure.

Reasons for Partitioning

- The reasons for partitioning a data flow diagram into separate computer programs are:
  - Different user groups should have different programs.
  - Processes that execute at different times must be in separate programs.
  - Processes may be separated into different programs for security.

Reasons for Partitioning (Continued)

- Similar tasks may be included in the same program.
- Several batch processes may be included in the same program for efficiency.
- Several processes may be included in the same program or job stream for consistency of data.

Partitioning Web Sites

Web sites are partitioned into pages.

- Improves speed of processing
- Easier Web page maintenance
- Different pages when reading different data
- Partitioned for security, separating pages using a secure connection from those that do not

Communicating Using Data Flow Diagrams

Data flow diagrams can be used for several different purposes:

- Unexploded data flow diagrams are useful to identify information requirements.
- Meaningful labels should be used for good communication.